REMARKS

Pursuant to 37 C.F.R. § 1.111, Applicant respectfully requests reconsideration of the non-final claim rejections set forth in the Office communication dated September 21, 2006.

Summary

Claim 12 is currently amended to correct a typographical error. The current amendment is not related to the patentability of the claimed subject matter and does not add new matter.

Claims 11 – 24 are pending.

Allowable Subject Matter

Claim 17 was objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections – 35 U.S.C. § 112, first paragraph

Claims 11 – 24 were rejected pursuant to 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. Any analysis of whether a particular claim is supported by the disclosure in an application requires a determination of whether that disclosure, when filed, contained sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make and use the claimed invention (MPEP 2164.01). The cited reference 6,214,766 notes the common use of starch in paper (column 1, lines 10 – 15). Cited reference 5,063,163 notes the differences in starch content for different types of paper (currency v. non-currency grades) (column 2, lines 46 – 53). As shown in *What You Need to Know About Starch in Papermaking,* attached as Appendix A, one skilled in the art should know how much starch content is in non-currency paper. The absolute amount of starch is not claimed, only a relative amount. As indicated by the references above, non-currency grade paper clearly includes substantial or detectable amounts of starch, especially as compared to currency paper. A person of ordinary skill in the art knows non-currency grade paper includes starch, so would understand a material

having lower starch content. Therefore, claims 11 – 24 fully comply with the enablement requirement.

Claim Rejections – 35 U.S.C. § 112, second paragraph

Claims 11 – 24 were rejected pursuant to 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 11 recites comparative starch content, not an absolute content. Therefore, claims 11 – 24 point out the claimed subject matter.

Claim Rejections

Claims 11 – 16 and 18 – 23 were rejected pursuant to 35 U.S.C. § 102(b) as being anticipated by Collings (U.S. Patent No. 5,188,871). Claims 11 – 14, 16, and 18 – 23 were rejected pursuant to 35 U.S.C. § 102(b) as being anticipated by Ahlm, Jr. et al. (U.S. Patent 3,001,887). Claim 24 was rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Collings in view of Kurrle (U.S. Patent No. 6,214,766). Claim 24 was rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Ahlm, Jr. et al. in view of Kurrle.

Claim 11 recites, *inter alia*, providing a first material having a lower starch content than non-currency grade paper forming the coupon.

Collings fails to disclose or suggest providing a first material having a lower starch content than non-currency grade paper forming the coupon. Collings fails to teach a first material. In all three aspects taught by Collings, a security paper authenticating system comprises "a security paper carrying both starch and an iodate salt, and an authenticating composition comprising an acidic solution of an iodide salt" (column 3, lines 11 – 15; see also column 3, lines 20 – 26 and column 3, lines 27 - 34). "[T]he system being such that on applying the authenticating composition to authentic security paper, iodine is generated and a characteristic starch-iodine colouration is produced" (column 3, lines 15 – 19). The arrangement disclosed by Collings is also disclosed in the BACKGROUND of the present application. Collings discloses a composition that changes the color of "security paper carrying both starch and an iodate salt" (column 3, lines 11 – 15). No material with a lesser

starch content is provided on or within the paper. Therefore, claim 11 is allowable over the cited reference.

Ahlm, Jr. et al. fail to disclose or suggest providing a first material having a lower starch content than non-currency grade paper forming the coupon. Ahlm, Jr. et al. disclose a paper printed with colloidal silica 11 (column 3, lines 35 – 39). When developing solution 13 is "brought into contact with the latent printed words" a color is formed (column 3, lines 40 – 43). Ahlmn, Jr. et al. teaches that the color is a dark, "deeply colored print" (column 3, line 19). Ahlm, Jr. et al. use benzene with other chemicals to react with silica (column 2, line 43 – column 3, line 26). Therefore, Applicants respectfully disagree with the Examiner's assumption that "[b]ecause Ahlm, Jr. is silent of starch, one of ordinary skill in the art could ascertain that the coupon is free of starch, rendering it to have a lower starch content than non-currency grade paper" (Office action dated September 21, 2006; page 4). Ahlm, Jr. et al. use chemical reactions other than starch, so do provide for no or more starch. Accordingly, claim 11 is allowable over the cited reference.

Applicant also respectfully notes that the claim 11 rejection pursuant to 35 U.S.C. § 102(b) as being anticipated by Ahlm, Jr. et al. is improper because Ahlm, Jr. et al. fails to disclose each and every element of claim 11 as required for an anticipation rejection. The Examiner relies on an assumption that one of ordinary skill in the art could ascertain one of the features. This assumption is *prima facie* evidence that each and every element is not taught by the recited reference. Therefore, Applicant respectfully requests that the claim 11 rejection pursuant to 35 U.S.C. § 102(b) as being anticipated by Ahlm, Jr. et al. be withdrawn.

Dependent claims 12 – 16 and 18 – 19 depend from allowable claim 11, so are allowable for at least the same reasons as claim 11. Further limitations of the dependent claims are allowable over the cited references.

Claim 16 recites the area substantially maintains a color due to avoiding a reaction with a trace chemical residual in an authentic coupon. Collings fails to teach a first material. However, Collings teaches that authentication is marked by "starch-iodine colouration" (column 3, lines 12 – 34). Collings teaches a darker color for authentication. Collings also

teaches that a composition that "lessens the colour generating effect" is undesirable (column 4, lines 37 – 39). As taught by Ahlm, Jr. et al. a reaction creates a "distinctive, conspicuous color, and the authenticating words, symbols or designs are rendered visible and legible" (column 2, lines 49 – 53; column 3, lines 27 – 48). The references do not suggest maintaining a color by avoiding reaction as authentic.

Claim 18 recites applying a coating having substantially no trace chemical residual on the coupon. Collings fails to teach a coating. Ahlm, Jr. et al. teach applying colloidal silicia, which contains trace chemical residuals (column 1, lines 50 – 55; column 4, lines 50 – 75).

Independent claim 20 recites, *inter alia*, adding a material substantially free of trace chemical residuals to the coupon. As discussed above, Collings fails to disclose adding a material to the coupon (column 3, lines 13 – 34). Ahlm, Jr. et al. teach a contrary arrangment. Ahlm, Jr. et al. teach "this invention is produced by treating ordinary writing, book or magazine paper with a colloidal silica" (column 1, lines 50 – 52). Accordingly, claim 20 is allowable over the cited references.

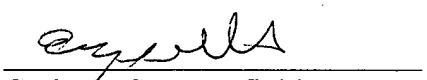
Dependent claims 21 – 24 depend on claim 20, so are allowable for at least the same reasons as claim 20. Further limitations of the dependent claims are allowable over the cited references. For example, claim 21 recites coating the coupon with the material substantially free of starch. Collings fails to teach coating a coupon with a material. Ahlm, Jr. et al. does not mention starch and suggest that the composition applied to the paper has starch as discussed above.

CONCLUSION

For at least the reasons presented above, the Applicants respectfully submit that the pending claims are in condition for allowance.

The Examiner is respectfully requested to contact the undersigned in the event that a telephone interview would expedite consideration of the application.

Respectfully submitted,



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WHAT YOU NEED TO KNOW ABOUT STARCH IN PAPERMAKING

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Starch application in papermaking dates back to the invention of paper itself 2000 years ago, when starch was applied to paper for a stronger, smoother writing surface. For mineral filler containing papers, starch is the highest volume raw material after water, fiber, and fillers.

Starch contributes to papermaking by providing functional properties and serving as a process aid. Paper mills use starches from various sources, such as regular corn, waxy maize, tapioca, potato, and wheat. Usage depends on availability and economics in a given region. Worldwide paper starch consumption consists of 67% corn, 15% potato, 8% tapioca, and 3% waxy maize, according to market estimates

Starch manufacturers sell "native" and several types of modified starches to the paper industry. Mills normally purchase starch in dry powder form and cook it onsite prior to application. Modified starches in general offer better value than native starches, providing more consistent starch quality coupled with the starch supplier's application expertise.

WHAT YOU WILL LEARN

- How starch contributes to the papermaking process
- Global trends in starch usage
- Starch application methods
- The benefits of using modified starches

ADDITIONAL RESOURCES

- ***Starch and Starch Products in Surface Sizing and Paper Coating,*** H.W. Maurer, ed. ISBN: 1930657560. This monograph discusses the properties and uses of starches, specifically the application of starch and starch products for surface sizing and coating of paper and paperboard. 2001. 170 pages, soft cover. This text is available from TAPPI Press. For more information, go to www.tappi.org and enter the following Product Code in the search field. 0101R297. Or, call 800 332-8686. Member Price: $102.00 Non-Member Price: $156.00

STARCH UTILIZATION

Starch utilization in papermaking depends on the type of paper, other raw materials used, papermaking technology, desired end properties, and paper machine productivity needs. For example, tissue grades typically use low amounts of starch or no starch while fine printing and writing papers can use up to 10% starch by paper weight. A higher amount of starch is used in paper grades containing higher mineral fillers to maintain strength and printing properties.

Traditionally, starch has been used as a dry strength and surface improvement aid. But in alkaline papermaking, starch is a critical part of wet-end sizing. Starch is an integral part of microparticle retention systems. Surface starch also works as a binder, water holding agent, and carrier for surface sizing chemicals and other functional additives.

The global paper industry uses about 5 million tons/yr of starch. That amounts to about 1.5% starch by weight across all grades of paper and paperboard. Modified starch usage is more common in the United States, where modified starches not only increase productivity, but also paper quality. For example, in 2004, of all the corn-based starch used by the paper industry in the United States, 76% was modified, according to the Corn Refiners Association.

Corn-based starches account for more than 95% of all starch utilization by the paper industry in the United States. Modified corn starch consumption grew by 14% during 2004 from 2003, while native corn starch consumption dropped 10.5% in the same period. Including starches based on other raw materials, the share of modified paper starches in the United States is even higher than 76%. Of all modified corn starch shipped by the members of Corn Refiners Association, 66% went into paper manufacturing.

By contrast, less than 60% of the starch used by the Asian paper industry is modified starch. As environmental enforcement becomes stricter and the quality of paper rises in Asia, the trend will be to use more modified starch to control waste discharge, enhance paper quality, and increase productivity. As Asian economies and standards of living continue to grow, paper production is expected to rise correspondingly. Modified starch opportunities in Asia are expected to grow at a faster rate than paper production due to improvement in paper quality and utilization of higher than usual amounts of recycled fibers, agricultural fibers, and mineral fillers.

CONTRIBUTIONS OF STARCHES TO PAPERMAKING

As mentioned before, starches were traditionally used for imparting dry strength and enhancing surface integrity when paper was made primarily from fiber. Over time, requirements have changed as papermaking has evolved into a complex process using nontraditional raw materials, including recycled fiber, agricultural fiber, mineral fillers,

and myriad chemicals designed to improve the papermaking process and functional paper properties.

Today, starch is used in wet end applications with pulp to enhance dry strength, including the ply bond and stiffness of paper, and to improve fines and chemical retention, drainage, internal sizing, formation and printability. It is also used to lower refining energy, biochemical oxygen demand, and overall paper manufacturing costs. Surface starches improve surface as well as internal strength and printability. A pictorial display of starch contributions to papermaking is presented in **Figure 1.** For example, when used properly, modified wet end starches allow higher utilization of low cost mineral fillers to replace expensive fibers and reduce refining energy needs by providing additional paper strength. Reduction in refining allows additional drainage on the wire, leading to energy savings in pressing and drying operations.

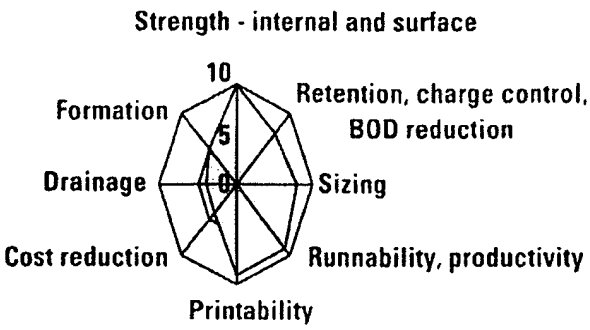

Figure 1. Illustration of starch contributions to papermaking. The primary use of starch has been for dry strength.

Wet end starch also works as a protective colloid for reactive sizes in alkaline papermaking. Wet-end starch anchors and distributes the reactive sizes to the papermaking fibers, thus enhancing the cleanliness of the papermaking system and improving productivity.

There have been many examples of increased productivity. In one case, a mill using additional wet end starch eliminated wet press picking, allowing its paper machines to run for longer periods without breaks. In another case, use of modified wet end starch in place of synthetic polymer as an emulsifier for the reactive alkaline size eliminated deposits on paper machine elements, increasing productivity. Yet another paper mill was able to lower overall starch usage and reduce streaks on the paper machine when it used modified surface starch in place of onsite converted native starch. Use of modified starch at this mill not only reduced paper rejects, it also simplified the starch preparation system.

STARCH APPLICATION METHODS

Starches are applied in the papermaking process at several stages by different methods to achieve desired results. For example, the use of uncooked spray starch in the wet end in between plies in multiply grades has been found to increase ply bond strength. Mixing cooked, modified wet-end starches with the pulp improves strength, sizing, retention, drainage, formation, wastewater quality, and productivity.

Proper selection and application of modified starches ensures the benefits listed above. Starch addition rate, point of addition, and compatibility with other wet end chemicals are also critical to optimum performance of the selected wet-end starch. The application of starches during various papermaking steps is shown in **Figure 2.**

A major portion of starch is applied by pond or metering size presses on the surface of the paper. Surface starches applied with size presses increase internal strength and improve surface integrity, printability, and surface strength. In some paperboard grades, surface starches are applied with calenders to reduce fuzz and improve stiffness, printability, surface strength and curling tendency.

To reduce coating costs, some paper mills use starch solutions at the calender and size press as pre-coats prior to the application of expensive coating chemicals. In coated grades, starch acts as binder and rheology modifier in the aqueous coating and reduces costs by replacing expensive synthetic chemicals. Since they are natural, renewable, and biodegradable, starches are environmentally friendly.

ADVANTAGES OF MODIFIED OVER NATIVE STARCHES

The advantages of modified starches over native starches are manifold and include increased productivity and improved quality. As paper machines have become faster and wider, the impact of downtime and off-grade paper has become very costly. Therefore, the best value provided by modified starch over native starch is the reduction in downtime and improvement in paper quality. Additional benefits include:

- Improvement in wastewater discharge quality with charged starches
- Elimination of chemicals and equipment for on-site conversion of native starches
- Reduction in labor costs due to the simplicity of cooking and using modified starches
- Improvement in cooked starch stability and hence minimum starch rejection
- Attainment of consistent quality starch leading to reduced process variation
- Enhancement in overall operation due to vendors' service and application of best practices

One paper mill saw dramatic improvement in white water and paper quality by replacing native starch in the wet end with a cationic starch. This mill also reduced starch usage with cationic starch to achieve similar results. Another paper mill saw reduction in overall manufacturing costs, improvement in paper properties, and simplification of the starch preparation system when it used mod-

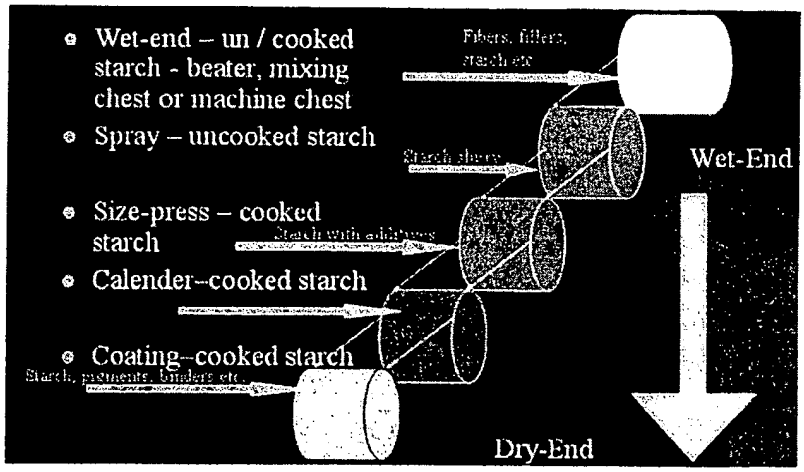

Figure 2. Starch application points in the papermaking process

ified surface starch instead of onsite converted native starch.

STARCH TYPES

There are several types of starches based on raw materials and modification methods. Potato starch used to be the dominant modified wet end starch in the United States a decade ago; however, this starch has been mostly replaced in the wet end by modified corn starches due to cost and availability. In Europe, too, modified corn starches have penetrated the wet end due to cost issues in spite of the region being well known for its potato starches. In Asia and Africa, several paper mills are using tapioca-based starches, whereas Australia is using wheat-based starches.

In most cases, wet end starches are cationic or amphoteric, whereas surface starches are oxidized or hydroxyethylated. Some of the relatively newer wet end starches include cross-linked, anionic, liquid or dry pre-gel and highly charged wet end starch. Other modified starches used for surface applications include hydroxypropylated, acetylated, acid modified, phosphate ester and dextrin.

The changing needs of papermaking have provided the opportunity for starch manufacturers to develop newer grades of starch to help improve paper quality and productivity. Starch applications experts help the papermaker choose the right type of starch for a given application for optimum productivity, quality and manufacturing cost.

THE MOVE TO MODIFIED

For several centuries, various types of starches have played key roles in improving paper quality, increasing productivity, and reducing overall cost. Being a natural biodegradable product, starch is considered environmentally friendly compared to synthetic chemicals. Since starch is an abundant, renewable product, it offers economic value to papermakers unparalleled by other chemicals. It still offers the best value when it comes to paper strength.

With increased use of alkaline papermaking, starch has become an essential part of alkaline sizing programs while starch used as a polymer has become essential for microparticle retention systems. Increased use of modified starch is on the horizon not only to improve quality and productivity, but also to meet or exceed rising environmental standards.

Some paper mills use native starch because of its lower price, but the overall cost of using native starch could be higher than modified starch due to lost productivity and lower paper quality. Paper mills must focus on their primary goal of producing paper and board at the highest quality and at the lowest cost. Since starch preparation systems in many paper mills are not considered to be a high priority, onsite converted native starches could in fact increase the overall cost of manufacturing due to:

- Off quality starch wastage
- Use of labor, chemicals and energy and
- Off grade paper production.

Starch suppliers that offer a proper selection and application of modified starches can help papermakers meet or exceed their goals. **S!**

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